

# STATUS OF FREQUENCY AND TIME SUPPORT FOR NASA SYSTEMS

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## ABSTRACT

The National Aeronautics and Space Administration (NASA) has Frequency and Timing Systems at many Facilities and Centers. This paper covers timing systems with specifications tighter than several microseconds. These ground based systems support scientific experiments and spacecraft tracking for the following programs: NASA Satellite Laser Ranging (NSLR); Network Mission Operations Support (NMOS); Kennedy Space Center (KSC); Very Long Baseline Interferometry (VLBI); Tracking Data Relay Satellite System (TDRSS) Ground Terminal Network, and the Deep Space Network (DSN).

Major equipment assemblies, specifications, performance and requirements, both present and future, will be presented.

## INTRODUCTION

This paper describes six NASA ground based timing systems currently in use, and the purpose of each timing system and the program supported. The major equipment; frequency standards, clocks, and time synchronization receivers are included. Related specifications and performance are listed. Some of these specifications and performance characteristics are presented in graphical form.

## NASA SATELLITE LASER RANGING NETWORK

The NASA Satellite Laser Ranging Network (NSLR) is a global network of both fixed and mobile laser ranging systems that measures the range to many satellites. These satellites are TOPEX, ERS-1, STELLA, LAEGOS I and II, STRAELLE, AJISAI and ETALON I and II. Another important function is providing precise orbit determination of operational satellites.

The centimeter accuracy of modern satellite ranging systems allow better estimates of the Earth's internal mass distribution, and global geodesy with accuracies of a few centimeters over continental distances.

Satellite laser ranging stations are located globally in over twenty countries and on every continent except Antarctica. The NASA network consists of four fixed stations and four transportable vans. The vans are moved approximately every six